Land Improvements— What You Need to Know

By E. F. Sedgley

Land improvements take many forms. In general, they are features added to the land to improve its productivity or meet special needs of the landowner.

Examples of common land improvements include water supply systems, drainage systems, pasture improvements, windbreaks, ponds, fences, roadways, and conservation measures.

Land improvements serve a variety of purposes. They may be necessary to protect property, to make possible various income-producing enterprises, or to provide recreation opportunities.

Whether you've already purchased a place in the country or plan to, an assessment of existing and potential land improvements is important.

Chances are you will not find the ideal country place with all the features you desire. Land improvements are usually expensive. Sometimes it is impossible to develop the improvements you would like because of adverse site conditions or legal constraints.

If you are seeking a place in the country, it's important that you be able to recognize the value of existing improvements and assess the feasibility and cost of improving submarginal land to meet your needs.

If you are looking for a country place with the desired improvements already established, learn to evaluate the quality of the improvements. Are the fences in good repair? Is the dam that creates the farm pond sound? Is the horse pasture well grassed? Are drainage or irrigation systems functional? Are there signs of serious erosion?

If you intend to start from scratch on an undeveloped piece of land, you need to be especially cautious in assessing

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the potentials for improvements. This is particularly true if you plan to move to a region with which you are unfamiliar.

Never buy a homestead unit "site unseen." Avoid the plight of a Virginia family that recently purchased a 120-acre undeveloped tract in Colorado's San Luis Valley through a mail transaction. The family envisioned a modest investment in land improvements since they knew the tract was undeveloped. Their mistake was equating unfamiliar conditions in Colorado with familiar ones in Virginia.

What the family did not know was that the land had no irrigation water rights, the area received less than 7 inches of annual precipitation, and the soils were too poor to grow almost anything. Local ranchers say this kind of land is good only to hold the world together. There is absolutely no way to improve this land to make it livable or productive.

The following sections are intended to provide basic information to help you assess the quality of existing improvements and to evaluate the need, feasibility, and cost of the improvements you may want.

Water Supply

In the country there is no city water system to supply you with treated water that is safe for domestic use and livestock.

Fortunate indeed is the country dweller who has a good well that supplies quality water to his home and a live stream or spring for watering his livestock.

If you intend to establish a country home on an undeveloped tract your first concern should be a water supply.

Availability of water varies considerably in different parts of the country. In areas of high precipitation, water-bearing aquifers frequently are close to the surface and wells shallow, dependable, and relatively inexpensive.

In more arid regions this may not be the case. Water has become a scarce commodity in much of the American West. Many western states are concerned about receding water tables; permits are required to construct all wells, and in some areas permits for domestic wells are being denied.

Even if you have the required permit, the cost of drilling a well may be prohibitive. Depth to water and the kind of geologic materials between the surface and the water generally govern the cost. Under normal soil conditions a well may be drilled and cased for around $15 a foot. If drilling through hard rock is required, the cost may reach $30 to $40 a foot. In many areas, wells reach reliable water sources in less than 100

feet. In others, the closest water may be at 500 to 600 feet.

In evaluating a recent application for wells by a land developer, the Colorado state engineer estimated the wells would require drilling to a depth of 2,000 feet and cost $30,000 to $50,000 per well.

Other costs associated with wells include pumps, power supplies, and storage facilities. Under favorable conditions you will need to figure a $2,000 to $3,000 investment for a well. In unfavorable situations the cost may be prohibitive.

Another concern in developing wells is water quality. In some areas ground water is so saline that it is unfit for human or livestock use. In mountainous areas ground water is frequently polluted by poorly designed waste disposal systems installed upslope.

A good source of information about the cost and feasibility of wells is the local well driller. He usually maintains drilling logs and is familiar with local conditions. The state agency that issues well permits may also be able to supply useful information. It may even be worth your while to hire a consulting geologist if you have serious doubt about the availability of water.

Undeveloped springs are sometimes a good source for both domestic and livestock water. Look for seepy areas that

Seepy area on a ranch developed into an excellent source of livestock water.

Duane Scott

might indicate a near-surface release from a water-bearing soil layer. Even if ponded water is not evident, you may be able to develop a good water source by installing a collecting wall and gravel-packed perforated pipe. With proper storage facilities a flow of a gallon or two per minute should meet your needs.

Be sure to check the quality of water from a spring. Your county Extension agent can usually arrange water-quality testing for a small fee. Developed springs should be fenced to prevent pollution from livestock.

Drainage Systems

Excessive soil water can be a serious limitation to most proposed land uses. Severe drainage problems may go unnoticed by the inexperienced. Land that is dry during the summer months may turn into a marsh during spring rainfall and snowmelt.

Learn to associate certain kinds of plants with soil moisture conditions. The appearance of sedges, rushes, or other water-loving plants is reason to suspect a high water table.

In areas of limy or alkaline soils, presence of salt crystals on the surface also indicates a high water table. These are brought to the surface in solution by excess water and precipitate out as the water evaporates.

Land with a high water table can sometimes be converted to highly productive uses by installing a drainage system. You will need expert advice to determine the feasibility of drainage.

An investigation should be made to determine the depth and direction of flow of the ground water. Drainage ditches running in the direction of flow are usually ineffective. A good system starts with an interceptor ditch or tile line across the direction of flow above the affected area. To function properly, all drainage systems must have an outlet at lower elevation than the area being drained.

Underground tile systems are more expensive than open ditch systems but have advantages that may make them worth the extra cost. They do not take up land and can usually be farmed over. Open ditch systems tend to clog with vegetation and can be breeding grounds for mosquitoes.

Before you drain your land, check local land use ordinances. It may be illegal to drain certain wetlands. You may also be denied government assistance if you plan to drain certain wetlands.

In some areas you may have to join an established drainage district to obtain access to an outlet system.

The cost of drainage is highly variable and must be deter-

mined through onsite study. You will need to compare the cost with the benefits you expect to receive.

An excellent source for assistance on drainage problems is your local soil conservation district. Through an agreement with the U.S. Soil Conservation Service (SCS), each district has a staff of SCS technicians to help them carry out a conservation program.

A request to your district is often all it takes to get technical assistance in designing and laying out a drainage system. You will have to make your own arrangements to have the system constructed.

Site was dry when house at bottom was built, and owner was unaware of flood plain hazard. Other building was lifted off its foundation and moved 300 feet by flood plain ice flow.

H. J. Lyford

R. B. Dean

You may be able to get adequate advice and assistance from a drainage contractor. Some contractors rely on SCS for technical services; others have the expertise needed for the entire job themselves, including design and layout.

In areas of high rainfall, a good surface drainage system may be necessary to carry off water from high intensity storms. If you are considering purchasing a small unit subdivided from a larger farm or ranch, make sure your lot is not located near the outlet of a terrace system or in an unprotected flood plain. Structures to protect you and your land may be expensive, impractical, or not permitted because of local restrictions.

Pasture Improvement

Overestimating the carrying capacity of land for livestock is perhaps the most common mistake made by new country dwellers. A saddle horse will eat 30 to 40 pounds of forage a day. A typical non-irrigated pasture in many parts of the country can produce only 500 to 1,000 pounds of usable forage per acre per year. It would take 30 to 50 acres of this land to pasture one horse for a year without supplemental feed and without degradation of the forage and soil resources.

Pasture-carrying capacities can be significantly increased by irrigation, rotation grazing systems, fertilization, or establishment of better species. But even with an improved pasture system, one acre of land will support a horse for only about four months.

Overgrazed pastures soon become barren or weed-infested areas that are erosion and health hazards. Local ordinances may require you to install erosion-control measures and curtail grazing on such areas.

Feeding hay or grain to your livestock, or leasing additional pasture to sustain them through the year, can be a significant unexpected expense.

Windbreaks. A mature windbreak of trees and shrubs around the homestead or along field boundaries is a valuable land improvement. It may take 20 years to grow an effective windbreak, but once established it will reduce fuel costs, protect property from high winds, reduce soil blowing, keep snow from drifting against buildings, attract wildlife, provide shelter for livestock, and add beauty to the landscape.

To be successful windbreaks must be properly designed and consist of adapted species. The most effective windbreaks contain three to five rows with the lower growing species on the windward side and the tallest species to leeward.

Individual plants must be properly spaced in the rows and the distance between windbreak and homestead carefully computed so that wind-blown snowflakes do not bury the homestead.

Windbreaks are relatively inexpensive to establish. Young plants are available from commercial nurseries, forestry agencies or other conservation agencies for around $15 to $30 per hundred. Planting may be done by hand or with planting machines, which can be rented in some areas.

In areas of high winds a cedar shingle can be hammered into the ground on the windward side of each tree to protect it during establishment.

To control weeds, cultivation between the rows is recommended for the first few years after planting.

In areas of undependable precipitation a drip irrigation system can be installed at a cost of about $1.70 per tree. These systems use very small amounts of water and are used only for the first two or three years to assure establishment.

Technical assistance for windbreak planting is available from conservation districts, SCS, and state forestry agencies.

Windbreak planted on the contour provides wildlife habitat and in a few years will offer protection from snow and wind, reducing fuel costs.

Duncan R. Warren

Farm Ponds

A farm pond is an attractive improvement to any country unit. Besides its esthetic value it can be used for recreation, livestock water, fish production, wildlife habitat, and fire protection.

A good pond site is one where the largest volume of water can be stored with the least amount of fill in the dam. Look for a place where the valley is narrow at the damsite and the reservoir area is wide and flat.

Size of the watershed above the site is important. It must be large enough to supply the water needed to fill the pond, but if it is too large it may be expensive or impractical to construct a dam and spillway to handle peak flows.

Extent of active erosion on the watershed above the pond is an important consideration. Too much erosion can fill your pond with sediment in a few years. It may be wise to delay building the dam until the watershed is stabilized with vegetation.

You will need to determine the suitability of the soils before building a pond. Soils with a high clay content are generally best, since they are relatively impermeable. Sandy or gravelly soils do not hold water and are unsuited for both dam construction and reservoir area.

It is necessary to clear the pond area of existing vegetation before beginning construction. This eliminates safety hazards and the possibility that the decomposition of plants may cause the dam fill to become unstable.

Depth of water in the pond is important. Shallow ponds produce excessive aquatic vegetation that is detrimental to most uses. Specific water depths are required for various species of fish, especially where live water is not continuously moving through the pond.

Ponds should not be constructed near feedlots, sewage disposal fields, mine dumps or other pollution sources.

If you cannot locate a good site on a natural drainage channel, you might investigate the possibility of an off-channel pond. This type of pond depends on an alternate water source, such as a spring or diversion from a nearby stream.

Off-channel ponds have some advantages over the in-channel type. Water supply can be controlled and sediment problems are usually eliminated.

It's advisable to test the water quality before you build a pond, especially if you intend to stock it with fish. Most fish species have definite tolerance limits to toxic elements, pH levels, and water temperatures.

Cost of building a pond may vary considerably, depending on size of the dam and the complexity of the site. Most small farm ponds are built for around $2,000 to $4,000.

Many states have laws that regulate the use of water and that specify acceptable criteria for dam design. Before you start building a pond, find out what laws apply.

You will need engineering assistance to help you select a proper site and to prepare plans and specifications for the dam.

You can obtain this kind of help from your local soil conservation district, or you may want to employ a private engineer.

R. L. Kent

Pleasing to the eye, farm ponds can be used for recreation such as swimming, fishing, and boating.

Don Baldwin

Fences. Fences serve a number of purposes in the country. They mark property boundaries, control livestock movement, regulate access by people and protect property. They may even add to esthetic values.

The most common fences in use today are the barbed wire fence and woven wire fence.

There are many types of wooden fences but their purpose is now primarily ornamental. While attractive, they are very expensive and much less effective in controlling livestock.

Barbed wire fences can cause injury to horses, especially around corrals or small pastures.

Fences represent a significant investment. A good barbed wire fence will cost about 30¢ a foot or $1,584 per mile installed. Woven wire fences cost nearly twice this amount; by comparison, a two-rail wooden fence costs around $1.65 per foot or about $8,700 per mile.

A barbed wire or smooth wire fence should have at least three strands of 12-1/2-gauge galvanized wire with class 2 zinc coating. Additional strands may be needed to confine small livestock such as sheep, goats, or ponies. Fence posts may be wooden or steel and should be spaced no more than 20 feet apart.

Wooden posts should be at least 3 inches in diameter and six feet long. They should be placed at least 18 inches into the ground. Corner and brace posts should be at least 5 inches in diameter, 8 feet long, and placed at least 3 feet into the ground and anchored.

Steel posts need to be driven into the ground so that the top of the anchor plate is level with the soil surface. They should be long enough to allow for a fence height of at least 42 inches.

Wooden posts made from cedar, juniper, osage orange, catalpa, black locust, or redwood contain natural preservatives. Most other wooden posts should be treated with a commercial preservative.

Standards and specifications for fences are available at local soil conservation districts.

Roadways

The importance of a good access road to the country home is frequently underestimated. If improperly designed, it may cause you considerable inconvenience and be a continuing expense.

If you plan to build a new roadway from a public road to your homestead you need information about soil properties,

topography, and drainage patterns. You also need to evaluate how well the proposed roadway will function under the most severe weather conditions expected in your locality.

Soil properties are extremely important. Soils with high clay content become very slippery when wet. Sandy soils frequently lack stability and erode easily.

Most roadways require surfacing with gravel or other suitable material. Gravel should be placed about six inches deep on the surface. The common 10-foot-wide tread width will require about 20 cubic yards of gravel per 100 feet of road.

Gravel costs are variable and depend largely on delivery distance. In most areas gravel is delivered for around $7 to $10 per cubic yard. This means a cost of $150 to $200 per 100 feet of road surface. There will be additional costs for spreading and packing the gravel.

Slope stability is an important consideration, especially in steep country. Roads cut into steep hillsides can fail completely if soils are unstable or have moisture moving through the soil profile.

Try to plan your road to avoid steep grades. If possible keep the roadway grade below 6 percent. Steep roads become extremely hazardous when covered with ice or snow.

Improper drainage is probably responsible for most unpaved roadway problems. The road should be sloped laterally to prevent water from running down the road surface. Small graded ridges called water bars are helpful in getting water out of ruts and into a planned drainage system.

Natural drainageway crossings are especially critical. Even the smallest gully may become a torrent during a high intensity storm. Most drainage crossings require a culvert, bridge, or grade dip to keep the water in its natural channel without damaging the road.

Design bridges and culverts large enough. The carrying capacity of culverts is often reduced by sediment or debris. Be sure they are installed at the proper grade.

New roadways can create serious erosion hazards, especially where cut and fill slopes are left exposed. These areas should be revegetated as soon as practical to stabilize slopes. You may also want to plant trees or shrubs to screen unsightly areas.

If your roadway project is complex you might need an engineer or surveyor to help you with planning and design. Local road departments are also good sources of information.

Advice concerning revegetation can be obtained from soil conservationists, Extension agents, and forestry agencies.

Conservation Measures

The term *conservation measure* applies to a wide range of land improvement practices including most of those discussed above.

Conservation measures are applied in various combinations to protect soil and water resources, improve productivity of the land, and create better environmental values.

On irrigated lands, conservation measures include such practices as land leveling, ditch lining, drainage, pasture establishment, and structures for water control.

In non-irrigated farming regions, where erosion from both wind and water are prevalent, common improvement practices include terrace systems, diversions, grassed waterways, grade stabilization structures, windbreaks, and small dams. A number of conservation practices are designed to improve range and woodlands. These include livestock water developments, brush control, proper grazing management, and various tree-management practices.

Special improvement practices to create benefits for wildlife or establish facilities for recreation are also considered conservation measures.

Several government agencies have programs designed to help the rural landowner with planning, financing, and carrying out land improvement measures relating to conservation.

If you move to the country, get acquainted with your local soil conservation district. It can give you the technical assistance needed to plan and lay out conservation practices. SCS provides most of the technical assistance to districts, and maintains standards and specifications for about 130 conservation practices.

You may be eligible for cost-share assistance on certain improvements through programs administered by the U. S. Agricultural Stabilization and Conservation Service. This agency works closely with SCS and is usually headquartered in the same building.

In some western states similar assistance is available under the Great Plains Conservation Program administered by SCS.

If you need financing to establish land improvement practices, contact your county representative of USDA's Farmers Home Administration. This agency makes low-interest loans for certain rural land improvements.

The U. S. Forest Service, through its state and private forestry program, provides excellent assistance in forest management and related activities. Many state forestry agencies provide similar assistance.